

Remarks/Arguments

Reconsideration of the above-identified application in view of the present amendment is respectfully requested. Applicants appreciate the allowance of claims 5, 7, and 10.

By the present amendment claim 1 has been amended to recite "An apparatus comprising a cold drawn induction-heated low-carbon steel tube, wherein the low-carbon steel tube is cold-drawn prior to induction heating, ..." Additionally claim 8 has been cancelled. Claim 8 was dependent from claim 1 and recited that the low-carbon steel tube is cold drawn. Also by the present amendment, claim 9 has been amended to recite "seamless" in order to correct a typographical error.

Below is a discussion of the obviousness rejection of claims 1 and 3 along with a discussion of the obviousness rejection of claim 9.

35 U.S.C. §103 rejection of claims 1 and 3 in view of U.S. Patent No. 6,290,789

Claims 1 and 3 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,290,789 B1 to Toyooka et al. (hereinafter, "the '789 patent").

In regards to the plastic properties recited in Claim 1, the Office Action mailed November 6, 2007 states that where the claimed and prior art products are identical or substantially identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established.

The Office Action mailed November 6, 2007 also states that the overlapping and broad ranges of elements, recited in the low-carbon steel tube of Claim 1, create a prima facie case of obviousness where the claimed ranges and prior art ranges do

not overlap but are close enough that one skilled in the art would have expected them to have the same properties.

Claim 1 is patentable over the '789 patent because: (1) the '789 patent does not teach or suggest a low-carbon steel tube that yields plastically more than about 5% before fracturing at temperatures down to about -100°C when stress sufficient to cause the low-carbon steel tube to so yield is applied to the low-carbon steel tube, and (2) the particular claimed ranges of elements in the induction heated low-carbon steel tube of claim 1 exhibit unexpected results relative to the ranges taught in the '789 patent.

The '789 patent teaches a low-carbon steel tube having a composition that overlaps the composition recited in claim 1. However, the '789 patent does not teach a low-carbon steel tube that yields plastically more than about 5% before fracturing at temperatures down to about -100°C when stress sufficient to cause the low-carbon steel tube to so yield is applied to the low-carbon steel tube. The Office Action argues that this plastic property is obvious because the composition recited in claim 1 is substantially identical to the composition of the '789 patent; therefore the claimed properties are inherent.

The plastic properties recited in claim 1 are not obvious in view of the '789 patent because the composition of the '789 is not substantially similar or identical to the composition recited in claim 1. As noted in the Office Action, the Federal Circuit has held that where the claimed invention and prior art products are identical or substantially identical in structure or composition, or produced by identical or substantially identical processes, a prima facie case of obviousness has been

established. The low-carbon steel tube does not have a composition that is substantially identical or identical to the composition of the low-carbon steel tube of the '789 patent; therefore, a prima facie case of obviousness is not established.

The low-carbon steel tube of claim 1 consists essentially of, by weight, about 0.07% to about 0.12% carbon, about 0.70% to about 1.60% manganese, up to about 0.020% phosphorous, up to about 0.015% sulfur, about 0.06% to about 0.35% silicon, about 0.25% to about 1.20% chromium, up to about 0.65% nickel, about 0.20% to about 0.70% molybdenum, up to about 0.35% copper, about 0.02% to about 0.06% aluminum, up to about 0.05% vanadium, up to about 0.25% residual elements, and the balance iron.

In contrast, the '789 patent, as noted in the Office Action, teaches a low-carbon steel tube with broad ranges of components that potentially touch and overlap the percent amounts of the components of the steel composition recited in claim 1. Moreover, the specific ranges of claim 1 are not taught or suggested by the '789 patent. None of the examples of the '789 patent teach a steel composition that falls within the percent amounts of the components recited in claim 1. Thus, the '789 patent merely teaches a broad range components that is neither identical or substantially identical to the claimed composition.

Additionally, a low-carbon steel tube formed using the steel composition recited claim 1 has substantially different mechanical properties than a low-carbon steel tube formed using the steel recited in the '789 patent. The low-carbon steel of claim 1 has a tensile strength of at least about 130,000 psi (896 MPa) and a yield strength of at least about 104,000 psi (717 MPa). As discussed below, none of

steels listed in the '789 patent, in contrast to the Office Action's statement, has a tensile strength of at least 896 MPa or a yield strength of at least 717 MPa. Steels listed in the '789 patent that have the highest tensile strength and yield strength are Nos. 2-4 (Table 17) and 1-6 (Table 15). Steel 2-4 has a tensile strengths of 796 MPa; while steel 1-6 has a tensile strength of 782 MPa, all well below 896 MPa of the steel of claim 1. The yield strength of steels 2-4 is 701 MPa; while steel 1-6 has yield strength of 687 MPa, both of which are below the 717 MPa of the steel claim 1. Further, these steels, 2-4, and 1-6, as noted in Table 3 and Table 14 of the '789 patent respectively, have compositions outside of the ranges recited in claim 1. Thus, steels taught in the '789 patent have different mechanical properties than the steels in claim 1.

Moreover, it well known to one skilled in the art that the mechanical properties of a low-carbon steel tube (and for that matter any article formed from steel) are a function of not just the composition of the low-carbon steel, but also of the processes used to form the low-carbon steel into the low-carbon steel tube. The process used to form low-carbon steel tube recited in claim 1 is substantially different than the process recited in the '789 patent. Specifically, the low-carbon steel tube of currently amended claim 1 is cold-drawn and then induction heated. In contrast, the low-carbon steel tube of the '789 patent is hot-drawn by induction heating and then cooled.

Accordingly, the low-carbon steel tube of claim 1 is not substantially identical to the low-carbon steel tube of the '789 patent. Furthermore, a retrospective view of inherency is not a substitute for some teaching or suggestion which supports the

selection and use of the various elements of a claimed composition. In re Newell, 891 F. 2d 899, 13 USP2d 1248 (Fed Cir. 1989). Therefore, the plastic properties recited in claim 1 would not be inherent in view of the '789 patent.

Additionally, the low-carbon steel tube recited in claim 1, exhibits unexpected results compared to the low carbon steel tube recited in the '789 patent. As noted in the Declaration under 37 CFR 1.132 provided in the October 24, 2006 response, from Mr. Erike, a senior technical specialist with over 20 years experience in materials engineering and metallurgy, an induction heated low-carbon steel tube having a composition as claimed exhibits unexpected properties compared to a convention heat-treated low-carbon steel tube having a similar composition.

Specifically, Mr. Erike states that:

It is common knowledge that steels exhibit a ductile-to-brittle fracture transition at low temperatures. The ductile-to-brittle fracture transition is a marked change in fracture resistance of steel with changes in one or more test variables. It occurs only in certain steels within ranges that depend on the steel. Temperature, stress state, and strain rate are among the variables that can give rise to fracture transition.

Experiments were performed comparing the maximum temperature of brittle area outbreak and tensile strength for examples (Ex. 1-3) of low-carbon steels having similar compositions but processed into seamless tubes using different processes. The results are plotted in the attached graph. For each of the examples 1-3, the low-carbon steel used to form the seamless tubes consisted essentially of, by weight, about 0.07% to about 0.12% carbon, about 0.7% to about 1.60% manganese, up to about 0.020% phosphorous, up to about 0.015% sulfur, about 0.06% to about 0.35% silicon, about 0.25% to about 1.20% chromium, up to about 0.65% nickel, about 0.20% to about 0.70% molybdenum, up to about 0.35% copper, about 0.02% to about 0.06% aluminum, up to about 0.05% vanadium, up to about 0.25% residual elements, and the balance iron. The maximum

temperature of brittle area outbreak was determined using a Charpy V-impact test on steel samples obtained from seamless low carbon steel tubes formed by the different processes. The tensile strength of steel samples obtained from seamless low carbon steel tubes formed by the different processes was measured in accordance with ASTM E8/E8M. In each of examples 1-3, the low carbon steel was cast, hot rolled to form a cylindrical billet, and then pierced to form a tube. The low carbon steel tube of example 1 was then quench tempered to a temperature of about 620°C and then cold drawn to form a seamless tube. The low carbon steel tube of example 2, after piercing, was cold drawn and quench tempered to a temperature of about 520°C. The low carbon steel tube of example 3, after piercing, was cold drawn and then induction heated to a temperature of about 520°C.

The low-carbon steel of example 1 had a tensile strength of about 925 N/mm² and maximum temperature of brittle area outbreak of about -20°C. The low-carbon steel of example 1 had a tensile strength of about 912 N/mm² and maximum temperature of brittle area outbreak of about -80°C. The low-carbon steel of example 1 had a tensile strength of about 925 N/mm² and maximum temperature of brittle area outbreak of about -105°C.

The low carbon steel of example 3, which was heat treated by induction heating, exhibited a remarkable improvement in maximum temperature of brittle area outbreak compared to the low carbon steel of examples 1 and 2 remaining ductile and plastic at temperatures below -100°C.

Based on my experience in low carbon steel engineering and seamless tube fabrication as well as my review of low-carbon steel and seamless tube fabrication literature, a low-carbon steel having plasticity down to about -100°C has not been previously formed.

Additionally, based on my experience in low carbon steel engineering and seamless tube fabrication, it would not be reasonable to expect that an low carbon steel heat treated by an induction heating process would out perform the same material produced with gas or electric furnace heat treatment process.

Thus, it is unexpected that a cold drawn induction heated low-carbon steel tube having a composition as recited in claim 1 would exhibit substantially improved ductility properties at temperatures down to -100°C compared to a low-carbon steel tube having a similar composition but heat treated by conventional heat treatment process.

Moreover, as noted in U.S. Patent No. 6,386,583, from which the present application claim priority, the steel of the present invention compared to low-carbon steels in the prior art has substantially improved mechanical properties (see tensile strength and yield strength noted above), exhibits no evidence of stress corrosion cracking when welded and subjected to a saturated air atmosphere at 80° C, and no evidence of hydrogen embrittlement upon welding. Therefore, the low-carbon steel tube of claim 1 exhibits unexpected results and withdrawal of the obviousness rejection of claim 1 is respectfully requested.

Therefore, the apparatus formed as recited in present Claim 1 is not substantially identical or identical to the composition of the low-carbon steel tube of the '789 patent and a prima facie case of obviousness is not established. Thus the '789 patent does not teach or suggest all of the limitations of claim 1 and allowance of claim 1 is respectfully requested.

Claim 3 depends from claim 1 and is allowable because Claim 1 is not substantially identical or identical to the composition or process of forming the low-carbon steel tube of the '789 patent. Additionally, claim 3 is patentable over the '789 patent because the '789 patent does not teach or suggest a low-carbon steel that

has a tensile strength of at least about 130,000 psi, a yield strength of at least about 104,000 psi, and an elongation at break of at least about 14%.

In regards to the yield strength recited in claim 3, the November 6, 2007 Office Action states that the '789 patent teaches a range of yield strength up to 99,786 psi, a range of tensile strength up to 136,770 psi, and that a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. Additionally, the Office Action mailed July 9, 2008 states that the applicant does not specifically address the examples from the '789 patent where $YS=99,786$ and $TS=136,700$ psi.

Claim 3 recites that the low-carbon steel tube has a tensile strength of at least about 130,000 psi, a yield strength of at least about 104,000 psi, and an elongation at break of at least about 14%. As discussed above in reference to the mechanical properties of the apparatus of claim 1, the '789 patent does not teach or suggest a steel that has a tensile strength of at least about 130,000 psi (896 MPa) and a yield strength of at least about 104,000 psi (717 MPa).

The Applicants have adequately addressed the examples of the '789 patent where $YS=99,786$ and $TS=136,700$ psi. In the response to the Office Action dated November 6, 2007, applicants stated that although steels with a "high speed" tensile strength of greater than 896 MPa are taught by the '789 patent, "high speed" tensile strength is not the same as "Tensile strength", which is distinguished by separate columns of data in the tables of the '789 patent. Moreover, even in the examples of the '789 patent that have a "high speed" tensile strength that fall within the range

recited in claim 1, the composition of those examples falls outside the composition ranges recited in claim 1. Thus, the '789 patent does not teach or suggest all of the limitations of claim 3 and allowance of claim 3 is respectfully requested.

35 U.S.C. §103 rejection of claim 9 in view U.S. Patent No. 6,290,789 and further in view of U.S. Patent No. 6,024,808.

Claim 9 was rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,290,789 B1 to Toyooka et al. (hereinafter, "the '789 patent") and further in view of U.S. Patent No. 6,024,808 to Kondo et al (hereinafter, "the 808 patent"). The Office Action states that the '789 patent in view of the '808 patent is applied as discussed in the office action mailed July, 9 2008.

The Office Action mailed July 9, 2008 states that the '789 patent discloses the invention substantially, however it does not disclose a seamless tube as recited in Claim 9. The Office Action mailed July 9, 2008 also states that the '808 patent teaches making a seamless steel pipe by hot working and a round billet is pierced and rolled to a hollow shell. The Office Action mailed July 9, 2008 concludes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to prepare the steel base pipe as taught by the '808 patent, since the '808 patent teaches rolling applies light reduction to the cast steel in order to improve metallographic structure.

Claim 9 depends respectively from claim 1 and is therefore allowable because of the aforementioned deficiencies in the rejection with respect to claim 1 and because the '808 patent fails to cure the deficiencies of the '789 patent.

The '808 patent teaches a method of manufacturing a seamless steel pipe. The '808 patent does not teach a cold drawn induction-heated low-carbon steel tube or even a method of manufacturing a cold drawn induction-heated carbon steel tube.

Therefore, claim 9 is patentable over the '789 patent in view of the '808 patent because the '789 patent in view of the '808 patent does not teach a cold-drawn induction heated low carbon steel tube wherein the low-carbon steel tube is seamless.

In view of the foregoing, it is respectfully submitted that the above-identified application is in condition for allowance, and allowance of the above-identified application is respectfully requested.

Please charge any deficiencies or credit any overpayment in the fees for this amendment to our Deposit Account No. 20-0090.

Respectfully submitted,

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